SECTION 02674

DISINFECTION OF WATER SUPPLY WELLS

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LANL MASTER CONSTRUCTION SPECIFICATION

When editing to suit project, author shall add job-specific requirements and delete only those portions that in no way apply to the activity (e.g., a component that does not apply). To seek a variance from applicable requirements, contact the discipline POC.

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PART 1 GENERAL

1.1 SECTION INCLUDES

A. Disinfection requirements for new or existing water wells, and permanent equipment and material used in water wells.

B. Dechlorination procedures for chlorinated water discharges.

C. Discharge requirements (point of discharge and chlorine concentration).

1.2 LANL PERFORMED WORK

A. Water quality testing: LANL will perform water quality testing of water samples taken from piping systems for chlorine concentrations and bacteriological quality. LANL will approve use of disinfected wells and well equipment when test results demonstrate compliance with the Maximum Contaminant Levels (MCLs) of the Safe Drinking Water Act as described in Section 1.3.D.

1.3 DESCRIPTION

A. Disinfection Requirements

1. Take precautions to protect the casing and fittings against contamination during construction. Arrange casing delivered for construction so as to minimize the entrance of foreign material.

2. Notify LANL Construction Inspector prior to any discharges as described in Section 1.3.B.

3. Disinfect well and well equipment as described in Section 3.1.

4. LANL will perform water quality testing of water samples taken from well for chlorine concentrations and bacteriological quality as described in Section 1.3.D.

5. Do not place well in service until notified by LANL Construction Inspector that water quality test results are approved by LANL, as described in Section 1.3.D.

B. Water Discharge Requirements – Contractor

1. Refer to Section 01325.
   a. Chlorinated waters used for disinfection shall be dechlorinated prior to discharge as described in Section 3.3.

   b. Hypochlorites and sodium thiosulfate may increase well water alkalinity beyond the pH limits allowed for discharge. Dechlorinated water may require acidification with a dilute acid such as vinegar to ensure that discharge pH is between pH6 and pH9.

2. Water discharged to environment shall comply with Water Quality Standards for Discharge of Waters based on general Notice of Intent to Discharge and State of New Mexico Groundwater and Surfacewater Quality Protection Regulations. pH of discharge water shall be greater than 6.0 standard units and less than 9.0 standard units, and have a maximum total chlorine concentration of 11µ/L (parts per billion). Maximum allowable concentration of other analyses are as follows:

Total Aluminum	5.0	mg/L
Total Arsenic	0.2	mg/L
Total Boron	5.0	mg/L
Total Cadmium	0.05	mg/L
Total Chromium (Cr(III) and Cr(VI))	1.0	mg/L
Total Cobalt	1.0	mg/L
Total Copper	0.5	mg/L
Cyanide, weak acid dissociable	5.2	µg/L
Total DDT and Metabolites	0.001	µg/L
Total Lead	0.1	mg/L
Total Mercury	0.77	µg/L
Total PCB's	0.014	µg/L
Total Selenium	0.002	mg/L
Total Vanadium	0.1	mg/L
Total Zinc	25.0	mg/L
Radium-226 + Radium-228	30.0	pCi/L
Tritium	20,000	pCi/L
Gross Alpha	15	pCi/L
Oil and Grease	15	mg/L

No floating solids, and no visible oil, grease, or foam.

C. Water Discharge Requirements – LANL Construction Inspector.

1. Refer to Section 01325.

D. Water Quality Testing Requirements – Contractor

1. Notify LANL Construction Inspector at least 48 hours (2 working days) in advance to arrange for a free or total chlorine concentration test.

2. Notify LANL Construction Inspector at least 48 hours (2 working days) in advance to arrange for a bacterial quality test.

3. Requirements for demonstration of compliance with the Maximum Contaminant Levels (MCLs) of the Safe Drinking Water Act:

a. Total chlorine concentration of less than 1 mg/L (1 ppm).

b. The absence of any coliform bacteria.

c. Less than 200 noncoliform bacteria per 100 mL sample.

E. Water Quality Testing Requirements – LANL Construction Inspector.

1. LANL Construction Inspector will notify the Contract Safe Drinking Water Act (SDWA) Compliance Laboratory (667-0105) at least 24 hours (1 working day) in advance to arrange for a total chlorine concentration test.

2. LANL Construction Inspector will notify the Contract SDWA Compliance Laboratory (667-0105) at least 24 hours (1 working day) in advance to arrange for a bacterial quality test.

3. LANL Construction Inspector will notify the Contract SDWA Compliance Laboratory (667-0105) at least 24 hours (1 working day) in advance to arrange for monitoring batch treated discharge for pH and chlorine.

PART 2 CHEMICAL PRODUCTS

2.1 MATERIAL SAFETY DATA SHEETS

A. Maintain on site Material Safety Data Sheets (MSDS) for chemical products, including disinfection and dechlorination products.

2.2 ACCEPTABLE DISINFECTANTS

A. Sodium hypochlorite solution (bleach) contains approximately 5 percent to 15 percent available chlorine. Use care in control of conditions and length of storage to minimize its deterioration.

B. Calcium hypochlorite (HTH) granules contain approximately 65 percent available chlorine by weight. HTH will not readily dissolve in water with a temperature of less than 41 degree F. Store HTH in a cool, dry, and dark environment to minimize its deterioration. Direct placement of solid phase HTH into piping is not permitted.

C. Disinfection with chlorine gas or liquid is not permitted.

2.3 ACCEPTABLE NEUTRALIZING AGENTS

A. Use sodium thiosulfate (technical grade, prismatic rice) as neutralizing agent.

B. Use of sulfur dioxide gas is not permitted.

2.4 PRECAUTIONS

A. Calcium hypochlorite (HTH) is corrosive and is a strong oxidizer. Reducing agents (*e.g.* sodium thiosulfate), concentrated acids, and organic compounds (*e.g.* antifreeze, gasoline), can oxidize, burn or explode if they come into contact with HTH.

B. Do not use calcium hypochlorite (HTH) on solvent-welded plastic pipe or on screwed-joint steel pipe because of danger of fire or explosion from reaction of joint compounds with HTH.

C. Add any acceptable weak acid for pH to dechlorinated discharge after dilution and mixing of thiosulfate with chlorinated water to prevent release of sulfur dioxide gas.

PART 3 EXECUTION

3.1 DISINFECTION OF WATER WELLS

A. Disinfect permanent equipment and material to be installed in well just prior to its installation. Spray exposed areas of items with a solution having a total chlorine concentration of not less than 200 mg/L.

B. After permanent equipment is installed, disinfect well by the following:

1. Treat entire volume of water in well casing, and gauge lines, to a free chlorine concentration of not less than 50 mg/L (50 ppm). Use amounts of calcium hypochlorite (HTH) or sodium hypochlorite per 100 linear feet of water in entire well as follows:

Well-Casing Nom. Pipe Size *In.*	Calcium Hypochlorite (HTH) Required per 100 ft of water *(65-Percent available chlorine)*	Sodium Hypochlorite Required per 100 ft of water *(12 trade percent)*
4	1 oz	4 fl oz
6	2 oz	8 fl oz
8	3 oz	14 fl oz
10	4 oz	1.4 pt
12	6 oz	2.0 pt
16	10 oz	3.5 pt
20	1 lb 1 oz	0.7 gal
24	1 lb 8 oz	1.0 gal
30	2 lb 6 oz	1.5 gal
36	3 lb 6 oz	2.2 gal
48	6 lb 1 oz	3.9 gal
60	9 lb 7 oz	6.1 gal

a. Disinfection by calcium hypochlorite (HTH): Distribute calcium hypochlorite evenly throughout water column with a chlorine basket. Run basket to bottom of well and retrieve it. Repeat process until calcium hypochlorite is dissolved.

b. Disinfection by use of sodium hypochlorite solution: Ensure sodium hypochlorite solution reaches all parts of well.

2. Following application of chlorine solution, surge well at least three times to improve mixing and induce contact of chlorinated water with adjacent aquifer. Allow chlorinated water to remain in casing for at least 12 hours, but not more than 24 hours.

3.2 PUMPING OF WELL FOLLOWING DISINFECTION

A. Notify LANL Construction Inspector prior to discharge of water from well as described in Section 1.3.C.

B. Contact LANL Construction Inspector to arrange for final total chlorine concentration and bacteriological quality tests as described in Section 1.3.D.

C. All discharges from pumping shall conform with Section 1.3.C. Method of dechlorination of discharges is described in Section 3.3.

D. After chlorinated water has remained in casing for at least 12 hours, but not more than 24 hours, pump well to remove chlorinated water.

E. The Contract SDWA Compliance Laboratory will periodically test discharge water for determination of total chlorine concentration.

F. When total chlorine concentration of discharge is zero mg/L, continue pumping well for at least 15 minutes.

G. Section 3.2.F, the Contract SDWA Compliance Laboratory will collect at least duplicate samples, to be taken not less than 30 minutes apart for and bacteriological quality tests.

H. After final total chlorine concentration and bacteriological quality tests have been completed, LANL Construction Inspector will furnish disinfection report to Contractor. If water quality tests do not show compliance with the Maximum Contaminant Levels (MCLs) of the Safe Drinking Water Act as described in Section 1.3.D, re-disinfect well until test results demonstrate compliance.

3.3 DECHLORINATION OF DISCHARGES

A. Sodium thiosulfate crystals may be applied manually or a liquid solution of sodium thiosulfate may be directly injected into chlorinated water discharge pipe using a metering pump or venturi ejector.

B. Provide mixing tank to allow dechlorination of water prior to discharge.

C. Approximate dosage rate of sodium thiosulfate may be calculated from the following table:

Free Chlorine Residual Concentration	Sodium Thiosulfate
10 mg/L	1.2 lb./10,000 gal
50 mg/L	6.0 lb/10,000 gal
500 mg/L	60.0 lb/10,000 gal

D. Do not overdose sodium thiosulfate beyond the minimum required to neutralize the chlorine actually present in discharge.

END OF SECTION